HWG | HARRIS, WILTSHIRE & GRANNIS LLP

EX PARTE OR LATE FILED

May 10, 2016

REDACTED — FOR PUBLIC INSPECTION

Ex Parte

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Katie King
Telecommunications Access Policy Division
Wireline Competition Bureau
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: *Connect America Fund, WC Docket No. 10-90, Universal Service Reform – Mobility Fund, WT Docket No. 10-208A*

Dear Ms. Dortch and Ms. King:

On behalf of General Communication, Inc. ("GCI"), the undersigned counsel submits the redacted version of the attached model pursuant to the *Second Protective Order*.[1] As required by the *Order*, we have requested and received written approval to designate a portion of the attached presentation as Highly Confidential. Pursuant to the *Order*, we submit (a) one copy of the filing containing Highly Confidential Information to the Secretary's Office along with the corresponding cover letter; (b) two copies of the filing in redacted form to the Secretary's Office along with this cover letter; and (c) two copies of the filing containing Highly Confidential information to Katie King, of the Telecommunications Access Policy Division of the Wireline Competition Bureau. We will also file a redacted copy of this model via ECFS.

[1] *See Connect America Fund, High-Cost Universal Service Support*, Second Protective Order, DA 12-192, 27 FCC Rcd. 1494 (2012).

Please contact me if you have any questions.

Sincerely,

John T. Nakahata
Counsel to General Communication, Inc.

cc: Jim Schlichting
Paroma Sanyal
Margaret Wiener
Susan McNeil
Audra Hale-Maddox

Enclosure

REDACTED — FOR PUBLIC INSPECTION

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Connect America Fund	)	WC Docket No. 10-90
	)	
Universal Service Reform – Mobility Fund	)	WT Docket No. 10-208A

Modified Alaska Mobile Broadband Cost Model

William P. Zarakas
David Kwok

The Brattle Group

May 2016

TABLE OF CONTENTS

Figures and Tables

I. INTRODUCTION

In 2012, GCI requested that *The Brattle Group* develop a model that estimated the incremental cost of providing mobile broadband service specifically to residents of the State of Alaska. This request was founded on the understanding that the geography, population and infrastructure of Alaska are unique compared to most, if not all, of the rest of the U.S., consequently more generalized cost models may not be fully applicable to estimating the costs of providing mobile broadband service in Alaska.

GCI recently asked *The Brattle Group* to modify and update this model to account for the advancement of wireless service since the model was submitted to the Commission in 2013,[1] and to estimate the incremental costs of providing 4G LTE service to the population of Remote Alaska[2] that does not have access to such service today from AT&T or Verizon Wireless.

The Modified Alaska Mobile Broadband Cost Model estimates the cost of providing 4G LTE service to specific areas within the State of Alaska.[3] Roadways as well as local community locations were considered in defining the areas targeted for 4G LTE service. In summary, the cost model:

- Segments Remote Alaska into: 1) census blocks that have some mobile service, but that are not covered by 4G LTE service over AT&T or Verizon Wireless facilities ("Alaska Plan Served Census Blocks");[4] and 2) census blocks that have no wireless service

---

1 *The Brattle Group* provided a report entitled "Alaska Mobile Broadband Cost Model" to the Commission in February 2013.

2 Remote Alaska is defined as all Alaska census blocks except the ACS-Anchorage incumbent study area; the ACS-Juneau incumbent study area; the Fairbanks zone 1 disaggregation zone in the ACS-Fairbanks incumbent study area; and the Chugiak 1 and 2 and Eagle River 1 and 2 disaggregation zones in the Matanuska Telephone Association incumbent study area.

3 For purposes of this analysis, we assume that 4G LTE service provides 2 Mbps download and .8 Mbps upload at the edge of the cell in census blocks served by terrestrial middle mile facilities (i.e., fiber optic or microwave) and 1 Mbps download and .256 Mbps in census blocks served by satellite middle mile.

4 *See* supra III.A.

("Alaska Plan Unserved Census Blocks").[5] We refer to these two segments collectively as the "Alaska Plan Census Blocks."

- Aggregates detailed census block demographic and geographic data (i.e., population, area, road miles, existing cell sites and backhaul infrastructure) to the borough (the geographic organization of Remote Alaska) and census area level.

- Estimates the capital costs associated with building-out the network and the present value (PV) of ten years of operations and maintenance (O&M) costs. Costs are estimated for geographic areas based on the physical network infrastructure currently in place.[6] For instance, absence of any wireless facilities necessitates building-out 4G LTE infrastructure "from scratch." Where wireless facilities provide less than 4G LTE service, costs reflect the incremental investment and O&M expenses associated with upgrading services to reach 4G LTE.

In addition, the Modified Alaska Mobile Broadband Cost Model estimates the PV of ten years of backhaul costs, based on the type of backhaul currently accessible for the specific geographic areas considered. The PV of transport costs (from the primary hubs of Juneau, Fairbanks and Anchorage to the aggregation points in Seattle, Washington, or Portland, Oregon) was also estimated. Transport costs to the Lower 48 are reported separately, and not included in the total cost estimate, making the total cost estimate even more conservative. The bandwidth associated with backhaul and transport was determined at the borough / census area level to ensure economies of scale and/or volume discounts.

This report provides an overview of the Modified Alaska Mobile Broadband Cost Model and summarizes key model results (based on our recommended assumptions, set as default values in

---

[5] *See* supra III.A.

[6] We used this "brownfield" approach, because the wireless broadband infrastructure is relatively new, built in the last several years in many cases, and additional build-out or upgrades would likely take advantage of the existing infrastructure locations.

the model). Figures included in this report explain the organization of the cost model. This report is also designed to accompany the model in electronic format (i.e., Microsoft Excel).

The model has a number of configurable assumptions that allow the user to test the impact of changes in different assumed costs or service levels.

Section II of the report presents our results from the cost modeling, including the detailed costs for network build-out and operations, and the cost of undersea transport. Section III describes the cost model methodology, including our assumptions on the scope of build-out, the coverage analysis, and costs. Next, section IV describes our simulation of the existing level of wireless coverage in Alaska, as well as a determination of requirements to build-out infrastructure to provide 4G LTE services. Sections V and VI describe our estimates of cell site costs and backhaul costs, respectively. Section VII provides an estimate of the cost of undersea transport from points in Alaska to peering points in the Lower 48. (This cost is presented in order to provide full scope of costs associated with deploying 4G LTE, but is not included in the total cost estimate summarized in Section II below.)

II. SUMMARY OF RESULTS

The cost of providing 4G LTE service in Alaska is a function of: 1) the scope of the geographic areas covered; 2) the costs (capital and O&M) of building new cell towers and upgrading existing cell towers, plus the costs of building out or upgrading common network facilities and satellite ground stations where needed; and, 3) the costs of backhaul.

As indicated above, the cost model segments Remote Alaska into: 1) Alaska Plan Served Census Blocks (census blocks in Remote Alaska that have some mobile service, but that are not covered by 4G LTE service over AT&T or Verizon Wireless facilities); and 2) Alaska Plan Unserved Census Blocks (census blocks in Remote Alaska that have no wireless service).

The total cost and a break down between Alaska Plan Served Census Blocks and Alaska Plan Unserved Census Blocks is summarized in Table II-1. As indicated in the table, the present

value of the cost of providing 4G LTE service to all Alaska Plan Census Blocks is estimated to be roughly $1.511 billion. The table also indicates that roughly 86% (roughly $1.288 billion) of the estimated total costs are involved with providing 4G LTE service to the Alaska Plan Served Census Blocks, and approximately 14% (about $208 million) of total estimated costs are associated with providing 4G LTE service to Alaska Plan Unserved Census Blocks.[7]

For comparison purposes, the PV estimated for the total cost (excluding undersea transport) of bringing 4G LTE to Alaska Plan Census Blocks of $1.511 billion exceeds the PV of the Alaska Plan proposed funding. The Plan, as proposed, would provide $73,761,353 annually to Alaska CETCs to support, sustain, and upgrade areas that currently have at least 2G service but do not receive 4G LTE service from AT&T or Verizon. On a present value basis (using a 7.5% discount rate), the proposed funding over 10 years for these areas equals $506,303,898. In addition, the Alaska Plan proposes reassigning $22,158,519 (that currently supports urban areas) to unserved areas. The proposed funding for these unserved areas over 10 years is $152,097,868 on a present value basis.

Further breakdown of the cost of deploying 4G LTE services is presented in Table II-1, which separates the estimated total cost into cost components including capital costs (i.e., the costs of building out and upgrading cell sites, common network and satellite ground stations and equipment), the PV of ten years of O&M costs and the PV of ten years of backhaul costs. The table indicates that common network costs are nearly $15 million, and a total of $1.511 billion are associated with providing 4G LTE service in all Alaska Plan Census Blocks. Notably, roughly 84% of these costs are associated with backhaul (approximately $1.261 billion on a present value basis). The remaining 16% is associated with building, upgrading, and maintaining new cell sites (approximately $250 million).

---

[7] Nearly $15 million are associated with common network costs and not assigned to either served or unserved census blocks.

There is an additional cost of transport to connect the Alaska Plan Census Blocks with the Lower 48 states; that is, transport costs. These costs, which total approximately $59 million on a PV basis, are summarized in Table II-2.

III. COST MODEL – METHODOLOGY AND PROCESS FLOW

The Modified Alaska Mobile Broadband Cost Model begins with a detailed data set of each of the census block in Remote Alaska, which includes demographic data (i.e., population, land area and road miles at the census block level), geographic coordinates for cell towers currently in place, and an indication of the extent (if any) of wireline and/or wireless services currently provided.[8]

These data provide the basis for segmenting the State's geographic area into the Alaska Plan Served Census Blocks and the Alaska Plan Unserved Census Blocks. The Modified Alaska Mobile Broadband Cost Model then estimates the cost of providing 4G LTE service to specific areas within the State of Alaska based on the geographic data, and on historic and projected Alaska-specific costs.

Cost estimates are broken down in terms of major cost areas (capital costs for cell sites, other areas of capital costs, PV of O&M expenses and PV of backhaul costs), and are also summarized by geographic area (at the borough / census area level).

A. GEOGRAPHIC SCOPE

The most current data concerning population and other demographics are included in the 2010 Census, conducted and reported by the U.S. Census Bureau. Data are collected at the census block level, the most detailed level of dis-aggregation, which can then be aggregated into census blocks and census tracks or areas.

---

[8] These data are summarized in the cost model (in the "CB" "CB_Cov" and "Sites" tabs).

To identify the Alaska Plan Census Blocks, GCI overlaid the coverage shapefiles from the most recent Form 477 data (i.e., as of December 31, 2014) with the "populated portions" of 2010 census blocks in Remote Alaska (as defined by Commission rules) to compute the percentage of the population in each census block that is covered by each provider and technology. The populated portions of census blocks were estimated based on proximity to roads and the existence of non-governmentally owned land in an attempt to better approximate the actual locations of population within large census blocks. A census block was classified as served by AT&T LTE or Verizon Wireless LTE (and thus excluded from the Alaska Plan Census Blocks) if 85% of the population is covered by the AT&T or Verizon Wireless LTE Form 477 shapefiles.

To identify the Alaska Plan Served Census Blocks and the Alaska Plan Unserved Census Blocks, and to avoid the situation in which a single person in a census block would render that entire block "served," a census block was deemed to be served if the analysis demonstrated that 15% or more of the population in that block was within any carrier's coverage polygon, regardless of the level of service (i.e., including voice, 2G data, 3G data, or 4G LTE). As the Commission recognized in the *USF/ICC Transformation Order*, "[i]n Alaska, the average census block is more than 50 times the size of the average census block in the other 49 states and the District of Columbia, such that the large size of census areas poses distinctive challenges in identifying unserved communities and providing service."[9] A block was therefore categorized as "unserved" if less than 15% of the population in that block was within any carrier's coverage polygon.

B. INFRASTRUCTURE REQUIREMENTS

The infrastructure required for carriers to provide 4G LTE service in Alaska was determined through the coverage analysis. The coverage analysis involves determining the number of cell sites (i.e., existing and new) needed to cover the specified geographic areas, and the type of

---

[9] *Connect America Fund et al.*, Report and Order and Further Notice of Proposed Rulemaking, FCC 11-161, 26 FCC Rcd. 17,663, 17,788 ¶ 347 (2011) (citations omitted), *aff'd sub nom. In re FCC 11-161*, 753 F.3d 1015 (10th Cir. 2014).

backhaul (e.g., satellite, fiber, microwave, etc.) that is available to connect these cell sites to network facilities.

The number of cell sites needed to cover the selected areas was determined as follows:

- For the Alaska Plan Served Census Blocks, existing wireless carrier cell site locations were assumed to be efficient, and were used as the locations for upgraded cell sites. In certain cases multiple carriers had separate cell sites providing service to the same area. When cell sites substantially duplicated estimated coverage areas, one cell site was assigned in the cost model and the other was dropped from the analysis.[10]

- The Alaska Plan Unserved Census Blocks contain two separate groups of census blocks: 1) census blocks with no wireless service, but some telecom service provided by GCI; and 2) completely unserved census blocks. For the first group, we assumed that the locations of other telecom services could become efficient locations for the cell sites that would be used to provide 4G LTE service. For the second group, coverage ranges for existing cell sites were used as a proxy. Specifically, the number of road miles covered by wireless services per cell site for currently served areas was estimated for each borough / census area. These average road miles per cell site coverage ratios were used to estimate the number of new cell sites needed to cover currently unserved areas, based on road miles, within the same borough / census area.

C. Cost Elements

GCI provided the component cost elements required to provide 4G LTE service, as summarized below. The cost of providing 4G LTE service includes both the cost of capital investment as well as ongoing O&M expenses. The primary cost areas for a 4G LTE network in Alaska

[10] We received the coordinates for GCI's current cell sites and other locations at which GCI offers other telecom services. To supplement this list, we included the registered locations of other carriers' cellular towers. To estimate the coverage areas around these sites, we assumed each cell site had a 2 mile coverage radius.

include cell sites and backhaul from the cell site to the hub points (Fairbanks, Anchorage or Juneau). Costs can be categorized as: capital (i.e., investments in cell sites, common network and satellite ground stations), O&M, and backhaul and transport. There is also an additional cost of the undersea cable transport from the hub points in Alaska to aggregation points in either Seattle, Washington or Portland, Oregon.

Unit costs include the capital and O&M costs required to construct and operate a cell site and to connect it to a carrier's network. Unit costs were developed based on the actual experience and costs incurred by GCI.[11] The model estimates both one time and ongoing costs over the course of service life. Costs are converted to PVs in order to allow estimation of a total cost on a consistent basis. These cost elements are summarized below.

1. Capital Costs – Cell Sites

Cell site related capital costs include upgrades and new construction.

- Existing cell sites (costs to upgrade antennas, radios, and shelters from current wireless service levels to 4G LTE);

- New cell sites (costs to construct towers and shelters and deploy radio equipment necessary to provide average speeds of 4G LTE);

2. Capital Costs – Network and Satellite

Additional capital costs required to complete a 4G LTE network include:

- Network controls (MSC server);

- Satellite ground station upgrades and new installations for cell sites served by satellite backhaul;

---

[11] Since the GCI wireless network has largely been constructed in the last several years, historical costs and current backhaul lease rates were assumed to be applicable.

- Satellite costs (HUB iDirect Satellite);

3. O&M Costs

Annual O&M expenses required to operate and maintain cell sites are also estimated. O&M expenses include electric power, leases, and maintenance costs. Backhaul costs, while part of the cost of operating and maintain cell sites, were separately estimated, as discussed further below.

4. Backhaul Costs

Backhaul costs were estimated based on the type of backhaul deployed and population covered. For this analysis, fiber and microwave backhaul are considered to be "terrestrial" options. The other option, satellite, is considered separately.

Backhaul was assigned to cell sites based on the infrastructure currently in place in Alaska for those regions.[12] Specifically, the most cost efficient backhaul option was applied to cell site based on throughput requirements and options currently available. Construction of new fiber or microwave backhaul infrastructure was not modeled or considered. Backhaul costs are based on average distance to the hub points at the borough / census area level, and were provided by GCI.

5. Undersea Transport Costs

One additional unique feature of Alaska is that it has no transport aggregation points (i.e., connections to the nationwide Internet backbone) within the state. Rather, data must be carried by undersea cable from one of the three data hubs in Alaska (i.e., Anchorage, Fairbanks–via–Anchorage, and Juneau) to an aggregation point in the Lower 48 States. Specifically, from these hubs data can be transported over T1 or T3 cables to Seattle, Washington or Portland, Oregon. To estimate the total undersea transport cost, we estimate the total number of cables required based on the cumulative amount of data passing through each hub. Hub points were designated

[12] Generally, backhaul was defined by borough. However, for some boroughs with varied terrain, multiple backhaul types were applied based on regional designations.

by borough based on the closest proximity. Rates were provided by GCI and based on current rates.

IV. CELL SITE REQUIREMENTS

Table IV-1 provides a summary of GCI's estimate of cell site locations in Alaska as of 2015. The table indicates that there are currently 806 cell sites in Alaska, 291 of which are located within the Alaska Plan Served Census Blocks. These existing cell sites were used to estimate coverage for upgrading existing services in the Alaska Plan Served Census Blocks.

To estimate the additional cell sites required to cover the Alaska Plan Unserved Census Blocks, we calculated the average road miles covered per existing cell site for each borough / census area. We applied this average to the total unserved road miles located within each borough / census area. Road miles were calculated by using the GIS coordinates for roads included in the 2010 census.[13] Based on this road mile analysis, as indicated in Table IV-2, we estimate that an additional 189 cell sites will be required to provide mobile wireless service to the Alaska Plan Unserved Census Blocks.

We assume (based on engineering and planning analysis conducted by GCI) that the 291 cell sites that are currently in place to serve the Alaska Plan Served Census Blocks are sufficient to serve a 4G LTE network. Of these, 246 cell sites provide service at levels below 3G and 45 cell sites provide 3G service. These cell sites would need to be upgraded in order to provide 4G LTE level service.

As shown in Table IV-3, we estimate that 480 new and upgraded cell sites are required to provide 4G LTE service to the areas targeted in Alaska. Accordingly, cost estimates were developed for:

---

[13] The 2010 census provides road data in TIGER/Line shapefiles which provide the line layer of roads in Alaska. We input these data into a geographic information system (GIS) mapping software (TransCAD) to determine the location and distances of roads for each census block in Alaska.

- Upgrading 291 existing cell sites in Alaska Plan Served Census Blocks;

- Building an additional 189 new cell sites in Alaska Plan Unserved Census Blocks.

V. UNIT COSTS

Determining the total costs to provide 4G LTE service to all Alaska Plan Census Blocks is accomplished by multiplying the costs per unit by the number of units. The costs involved in providing 4G LTE service includes capital costs as well as ongoing expenses associated with operations and maintenance. A primary capital cost in deploying a 4G LTE network concerns the one time investments necessary to: upgrade existing cell sites to 4G LTE; construct new 4G LTE cell sites; as well as the capital costs associated with network controls (e.g., MSC servers). O&M expenses for cell sites are the ongoing costs for power, leases, labor and other recurring costs involved in running a cell site.

The unit costs used in the Modified Alaska Mobile Broadband Cost Model were provided by GCI, based on actual recent experiences with upgrading and/or building out cell sites, ground stations and central hubs in Alaska. Capital costs are presented as one-time expenditures and are therefore already in present value terms. Operations and maintenance expenses (as well as backhaul costs) are incurred over the course of the term of analysis and are therefore presented in present values of the cash flow over ten years.

A summary of the unit costs used in the Modified Alaska Mobile Broadband Cost Model are provided in Table V-1: Backhaul costs, a major recurring O&M expense, are discussed separately in the section below.

VI. BACKHAUL COSTS

Cell sites provide the communications link between customers and the edge of the mobile network. Traffic then needs to be transported from the cell site to network control points and

eventually to its final destination. This backhaul of traffic is frequently conducted over fiber optic lines or microwave facilities in much of the continental U.S. Use of these backhaul options requires that terrestrial fiber or microwave networks be physically in place. When they are not, alternatives, notably satellites, must be used. Terrestrial backhaul facilities tend to be in place in populated areas, where the costs of construction is justified by high utilization of facilities. Satellite transport is typically leased from satellite companies (instead of launching a dedicated satellite), and tends to be more expensive than fiber and microwave based backhaul. Despite the expense of satellite transport, the costs of constructing greenfield terrestrial backhaul options without some other external funding to serve isolated areas with low populations is often not efficient.

Table VI-1 provides a breakdown of the type of backhaul (terrestrial or satellite) used at the cell sites within a borough /census area. The type of backhaul was assigned to cell sites based on current usage in the case of existing cell sites and availability in the case of new cell sites. As shown in the table, 382 of the required cell sites will use terrestrial backhaul, and 98 of the cell sites will use satellite backhaul, for a total cell site requirement of 480 as discussed above.

Backhaul requirements (i.e., throughput) are estimated by considering the population served, upstream and downstream data rates, the oversubscription rate, and the traffic factor. The throughput requirements for satellite based backhaul were developed on a system wide basis. That is, satellite throughput was estimated based on the total population of the targeted areas served by cell sites which use satellite backhaul. This allows for the realization of scale economies, instead of incurring minimum fees for areas with low population. Our cost analysis is based on the assumption that sufficient satellite capacity exists to serve all satellite areas with 4G LTE. To the extent that limited supply drives the prices up, the cost of satellite based services would increase. Satellite backhaul costs include the costs of leasing capacity on satellites, the capital and O&M costs associated with remote ground stations, and the capital and O&M costs associated with a central hub point (i.e., HUB iDirect Satellite).

Fiber optic lines and microwaves are the primary options available for terrestrial backhaul, with the choice highly dependent on availability at the specific location of a cell site. Terrestrial backhaul options typically involve leasing various levels of capacity on a backhaul carrier's network (i.e., microwave at T-3; fiber at T-3 and 1 Mbps; and Terra at 1 Mbps). In the Modified Alaska Mobile Broadband Cost Mode, the specific terrestrial option used at each cell site was based on availability and cost efficiency.

A portion of terrestrial backhaul is over the TERRA network, a hybrid fiber optic and microwave symmetrical broadband network that connects rural areas of Alaska with Anchorage. GCI's wireless operations lease network capacity on TERRA-SW (from its wholly owned subsidiary UUI) based on defined rates and terms available to any carrier on a non-discriminatory basis, subject to standard volume and term discounts. We reduced TERRA prices from current levels in the Modified Alaska Mobile Broadband Cost Model to reflect the combination of expected annual decreases in prices and lower rates due to higher volumes of usage. This assumption results in TERRA prices (on a per Mbps basis) being comparable to the pricing of shorter microwave routes in Alaska.

Satellite backhaul pricing assumptions are configurable and shown in Table VI-2 and VI-3. Terrestrial backhaul pricing assumptions used in the cost model, including the assumptions for TERRA pricing, are also configurable and shown in Table VI-4. The specific costs of satellite and terrestrial backhaul depends on the actual population covered by the satellite area (for satellite backhaul) and the actual population covered by a cell tower and the distance of transport (for terrestrial backhaul). For demonstration purposes, Table VI-3 (which covers the HUB iDirect satellite portion of satellite backhaul costs) also estimates the costs for a sample coverage of 3,000 people and Table VI-4 (which covers terrestrial backhaul costs) estimates the cost for a sample covered population of 500 and a connection distance of 50 miles.

VII. UNDERSEA TRANSPORT COSTS

To be comprehensive in estimating the costs of providing 4G LTE services in Alaska, the cost of transport (as a category separate from backhaul) is also presented. Unlike many locations in the

Lower 48 states, there is no Internet peering location in Alaska. Therefore, an additional layer of middle mile transport is required to provide broadband services. This is accomplished through undersea cables that connect Alaska with Internet peering locations in Seattle, Washington and Portland, Oregon. The cost associated with this layer of transport is not included in the total estimate of providing 4G LTE service in Alaska. The PV of ten years of undersea transport costs is estimated to be approximately $59 million. Estimates of the cost of undersea transport from the Alaska Plan Census Blocks to peering points in the Lower 48 are provided in Table VII-1.

Adding this $59 million cost to the total estimated cost of providing 4G LTE service to the Alaska Plan Census Blocks (i.e., approximately $1.511 billion) would bring the total cost of providing 4G LTE service to these areas up to roughly $1.570 billion. The cost of backhaul (over terrestrial and satellites within Alaska) plus undersea transport (to get from Alaska to the Lower 48) would total about $1.320 billion, or approximately 84% of the total cost of providing mobile broadband to these areas.

VIII. ESTIMATED MARGINAL REVENUES

Expansion of a 4G LTE wireless network in Alaska will produce additional, or marginal, revenues for the wireless carrier, which may be considered to be an offset to the cost requirements associated with deploying 4G LTE services. Such marginal revenues will be realized in two ways:

- Incremental revenues from the 129,944 people in Alaska Plan Served Census Blocks currently in areas covered by wireless service that would be upgraded to 4G LTE; and,

- New revenue streams from the 5,619 people in Alaska Plan Unserved Census Blocks that would now be served by 4G LTE.

Estimating the incremental revenues expected to come from customers in the Alaska Plan Served Census Blocks requires estimating the percentages of customers who will 1) upgrade their

service levels from a voice/text plan only to a data plan and 2) data plan customers who will upgrade to 4G LTE levels. It also requires estimating the incremental average revenues per user (ARPU) for the various upgrades. Estimating the incremental revenues expected to come from customers in the Alaska Plan Unserved Census Blocks requires estimating the percentages of customers who will subscribe to plans covering voice/text, data or both, as well as the ARPU for the various plans. Estimates of marginal revenues are thus highly sensitive to these market penetration, market share and ARPU inputs and assumptions.

In the 2013 version of the Alaska Mobile Broadband Cost Model (covering deployment of a 3G network), we estimated that GCI might realize marginal revenues equal to roughly $6.2 million per year from upgrades and about $9.5 million per year from new subscriptions, for a total of about $157 million over 10 years, or $108 million on a present value basis. GCI expects that marginal revenues will remain at roughly the same level in this updated version of the cost model. GCI bases this view on its experience that ARPU is largely a function of bandwidth subscription, and that, for purposes of estimating incremental revenues, new and upgrading customers will likely subscribe to similar levels of service under both 3G and 4G LTE network deployments. GCI will be studying this issue further as it gains additional experience and will determine whether customer subscriptions and revenues diverge from this initial view.

REDACTED — FOR PUBLIC INSPECTION

Table II-1
Summary of Capital Costs and Present Value of O&M Costs
by Network and Backhaul Costs

	Capital Costs	Present Value of 10 Years of O&M Costs	Present Value of 10 Years of Backhaul Costs	Total Cost	Cell Sites	Marginal Cost Per Cell Site	Population	Cost Per Pop	Census Blocks	Cost per Census Block
Common Network Costs	$18,033	$41,976	$14,908,699	$14,968,708	480	$31,185	135,563	$110	4,394	$3,407
Alaska Plan Areas	$178,560,166	$71,815,224	$1,246,000,259	$1,496,375,649	480	$3,117,449	135,563	$11,038	4,394	$340,550
Terrestrial										
Wireless Unserved	*$69,166,770*	*$32,486,850*	*$46,999,671*	$148,653,291	150	$991,022	*4,196*	$35,427	525	$283,149
Wireless Served	*$60,197,357*	*$19,845,001*	*$439,408,659*	$519,451,017	187	$2,777,813	*31,260*	$16,617	985	$527,227
Current 3G	*$12,219,930*	*$4,775,535*	*$383,745,713*	$400,741,178	45	$8,905,360	*69,998*	$5,725	2,055	$195,008
Satellite										
Wireless Unserved	$17,983,360	*$8,446,581*	*$33,051,802*	$59,481,743	39	$1,525,173	*1,423*	$41,800	97	$613,214
Wireless Served	*$18,992,749*	*$6,261,257*	*$285,328,530*	$310,582,536	59	$5,264,111	*23,560*	$13,183	694	$447,687
Current 3G	*$0*	*$0*	*$57,465,885*	$57,465,885	0	$0	*5,126*	$11,211	38	$1,512,260
Total Costs	**$178,578,199**	**$71,857,200**	**$1,260,908,958**	**$1,511,344,357**	**480**	**$3,148,634**	**135,563**	**$11,149**	**4,394**	**$343,956**
Total Terrestrial Costs	**$141,584,057**	**$57,107,386**	**$870,154,043**	**$1,068,845,486**	**382**	**$2,798,025**	**105,454**	**$10,136**	**3,565**	**$299,795**
Total Satellite Costs	**$36,976,109**	**$14,707,838**	**$375,846,216**	**$427,530,163**	**98**	**$4,362,553**	**30,109**	**$14,199**	**829**	**$515,874**
Common Network Costs	**$18,033**	**$41,976**	**$14,908,699**	**$14,968,708**	**480**	**$31,185**	**135,563**	**$110**	**4,394**	**$3,407**

REDACTED — FOR PUBLIC INSPECTION

Table II-2
Transport Costs
Summary of Transportation Costs by Hub

	Satellite (Anchorage)		Anchorage		Fairbanks		Juneau		
	Population Served	PV (10 Years)	Population Served	PV (10 Years)	Population Served	PV (10 Years)	Population Served	PV (10 Years)	**Total PV**
Alaska Plan Areas	15,054	$7,464,393	33,945	$33,357,592	5,173	$5,119,695	12,930	$12,766,575	$58,708,254

Source: Brattle Analysis of Client data.

Table IV-1
Analysis of Current Cell Sites in Alaska
by Sites in Place In 2015

Borough / Census Area	AK Plan Served Census Blocks	Total Sites
Aleutians East	7	8
Aleutians West	3	7
Anchorage	2	161
Bethel	21	34
Bristol Bay	4	5
Denali	6	12
Dillingham	13	15
Fairbanks North Star	7	76
Haines	5	7
Hoonah-Angoon	3	7
Juneau	1	34
Kenai Peninsula	8	65
Ketchikan Gateway	6	16
Kodiak Island	15	22
Lake and Peninsula	13	15
Matanuska-Susitna	10	83
Nome	23	26
North Slope	20	45
Northwest Arctic	12	13
Petersburg	4	9
Prince of Wales-Hyder	12	17
Sitka	3	7
Skagway	2	3
Southeast Fairbanks	10	16
Valdez-Cordova	53	66
Wade Hampton	13	14
Wrangell	2	5
Yakutat	0	1
Yukon-Koyukuk	13	17
Total	291	806

Source: U.S. Census Bureau 2010 Census; GCI Cell Site Data; Carrier Cell Sites from FCC ULS database; Brattle Analysis.

Table IV-2
Determination of Cell Site Requirements
Alaska Plan Unserved Census Blocks

Borough / Census Area	Total Roads in Unserved Area (Miles)	Average Miles/Site	Additional Sites for Unserved Census Blocks
Aleutians East	5	7	1
Aleutians West	36	15	3
Anchorage	0	10	0
Bethel	54	5	10
Bristol Bay	0	11	0
Denali	12	13	1
Dillingham	8	6	2
Fairbanks North Star	44	18	3
Haines	17	13	2
Hoonah-Angoon	25	11	3
Juneau	67	8	9
Kenai Peninsula	39	18	3
Ketchikan Gateway	57	6	10
Kodiak Island	15	7	3
Lake and Peninsula	21	6	4
Matanuska-Susitna	61	21	3
Nome	25	6	5
North Slope	128	5	28
Northwest Arctic	14	15	1
Petersburg	1	4	1
Prince of Wales-Hyder	63	12	6
Sitka	50	26	2
Skagway	2	16	1
Southeast Fairbanks	267	14	20
Valdez-Cordova	84	12	8
Wade Hampton	19	5	4
Wrangell	1	54	1
Yakutat	0	19	0
Yukon-Koyukuk	486	9	55
Total	**1,600**	**8**	**189**

Source: U.S. Census Bureau 2010 Census; GCI Cell Site Data; Carrier Cell Sites from FCC ULS database; Brattle Analysis.

Table IV-3
Summary of Cell Site Requirements
to Complete 4G LTE Build-Out in Alaska

Borough / Census Area	AK Plan Unserved Census Blocks	AK Plan Served Census Blocks			Total Sites
		Below 3G	3G Service	Total	
Aleutians East	1	7	0	7	8
Aleutians West	3	3	0	3	6
Anchorage	0	2	0	2	2
Bethel	10	14	7	21	31
Bristol Bay	0	4	0	4	4
Denali	1	5	1	6	7
Dillingham	2	8	5	13	15
Fairbanks North Star	3	6	1	7	10
Haines	2	3	2	5	7
Hoonah-Angoon	3	2	1	3	6
Juneau	9	1	0	1	10
Kenai Peninsula	3	6	2	8	11
Ketchikan Gateway	10	4	2	6	16
Kodiak Island	3	9	6	15	18
Lake and Peninsula	4	13	0	13	17
Matanuska-Susitna	3	9	1	10	13
Nome	5	18	5	23	28
North Slope	28	15	5	20	48
Northwest Arctic	1	12	0	12	13
Petersburg	1	3	1	4	5
Prince of Wales-Hyder	6	12	0	12	18
Sitka	2	2	1	3	5
Skagway	1	1	1	2	3
Southeast Fairbanks	20	7	3	10	30
Valdez-Cordova	8	52	1	53	61
Wade Hampton	4	13	0	13	17
Wrangell	1	2	0	2	3
Yakutat	0	0	0	0	0
Yukon-Koyukuk	55	13	0	13	68
Total	189	246	45	291	480

Source: U.S. Census Bureau 2010 Census; GCI Cell Site Data; Carrier Cell Sites from FCC ULS database; Brattle Analysis.